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REGIONAL INFRASOUND MONITORING IN UKRAINE



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ABOUT THE MAIN CENTER OF SPECIAL MONITORING

The MCSM is a branch of the National Space Facilities Control and Test Center of the State Space Agency of Ukraine. Tasks of the MCSM:



- monitoring of the nuclear tests and monitoring of the compliance of the international treaties for non-proliferation and ban of the nuclear weapon



- monitoring of the earthquakes and geophysical phenomena on the territory of Ukraine and the Earth



monitoring of the radionuclide contamination in the atmosphere



- research in geophysics
- providing information about the geophysical situation for the government and the scientific institutions

The shows the map of National Network Monitoring of Seismic Ukraine, the data of which processed by MCSM. is Infrasound stations are also included in this network (Observation sites where there are microbarographs marked with red stars).





ABOUT THE MAIN CENTER OF SPECIAL MONITORING

Main Center of Special Monitoring (MCSM) serves as the National Data Center of the National system of seismic observations and improve the safety of the population living in earthquake-prone regions, the National Data Center of the International Monitoring System of the Comprehensive Test Ban Treaty and carry out control technical means for seismic and radiation environment and provides infrasonic, geomagnetic and radio research.



All data is sent to the National Data Center in real time. Then they are processed and archived. Organized **operational duty 24/7**, the duty analyst processes the data within **30 minutes**. For remote experts, there is a **Cloud service**. The processed information about events is immediately transmitted to state agencies for decision making and response.

The data format is miniSEED and CSS3.0. Processing Software - Geotool, SeisComP, PMCC

Infrasound Arrays (current time)





 28
 0

 10
 -24

 10
 -30

 10
 -40

 10
 -40

 10
 -40

 10
 -40

 10
 -40

 10
 -40

 11
 -40

 12
 -40

 132
 -40

 144
 -168

 158
 -120

 161
 -120

 172
 -240

 182
 -240

 183
 -240

 184
 -312

 185
 -312

DI microbarographs are combined into infrasound arrays (MAAG1, MAAG2 and MAAG3). Events are recorded and processed.

4 Chaparral Model 64 VX microbarographs were purchased. Now it's arrived at the Vernadsky station and installed in February 2021. For testing, the aperture is 150 meters.

The main task of the network is to monitor technogenic and natural activity and emergencies. At the same time, such a dense enough network can be successfully used to study the characteristics of the atmosphere.





DIGITAL MICROBAROMETER (DI)



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Frequency Range	Hz	0,001 - 15
Sensitivity in range 0,01 — 10 Гц	mV/Pa	not less than 20
		(-1% +1%)
Power	V	220 / 12 V
Dynamic range of the input signal	dB	not less than 120
Maximum pressure level (relative)	Ра	± 100
Output		differential
Noise level	mPa (mkV)	≤1
		(≤20 mkV)
Signal gain		5, 10, 50, 100
Noise reduction system volume	sm³	60-100
Noise reduction system inputs	pcs.	4
Weight	kg	Up to 5
ADC channels	pcs.	1
bit ADC	pcs.	24
ADC quantization rate	Hz	10, 20, 40, 80
Voltage measurement range	V	±10
Analog output	pcs.	1

18 digital condenser microbarographs released in 2019. Data is transmitted using the SeedLink protocol and stored in miniSEED format. A 4-channel multiplexer or Ethernet connection is used to collect data. Now preparing sites for their placement in the form of infrasound arrays. The images show the appearance of microbarographs and an example of recording.

Registration examples. Natural phenomena

Avalanches



Vrancea earthquake 11/11/2014



Volcanic eruption



Thunderstorm



Registration examples. Bolides

Meteorite explosion over



Chelyabinsk meteorite 02/15/2013





Registration of the Romanian meteorite 01/07/2015







Infrasound signals from a car explosion in the Russian Federation near Lipetsk 06/21/2018

Registration examples. Technogenic explosions



The explosion of Donetsk. June 16, 2015



Registration of explosions at the military arsenal near the city of Ichnia 09/10/2018



Registration of a mining explosion in a quarry



Conclusion

The scheduled upgrade of the sensors is currently underway. There are also plans for installing infrasound arrays in the Eastern and Southern Ukraine and in Antarctica (Vernadsky station). Furthermore, for assessing the possibility of recording large-scale processes in the atmosphere, the pilot plant of the microbarographs on the seismic array nodes PS45 is scheduled for this year. In this case, the distance between the elements of the infrasound array will be around 3-4 kilometers.

We hope that our efforts will end with the creation of a modern infrasound national network and that Ukraine will cease to be a "white spot" for the European scientific community.



